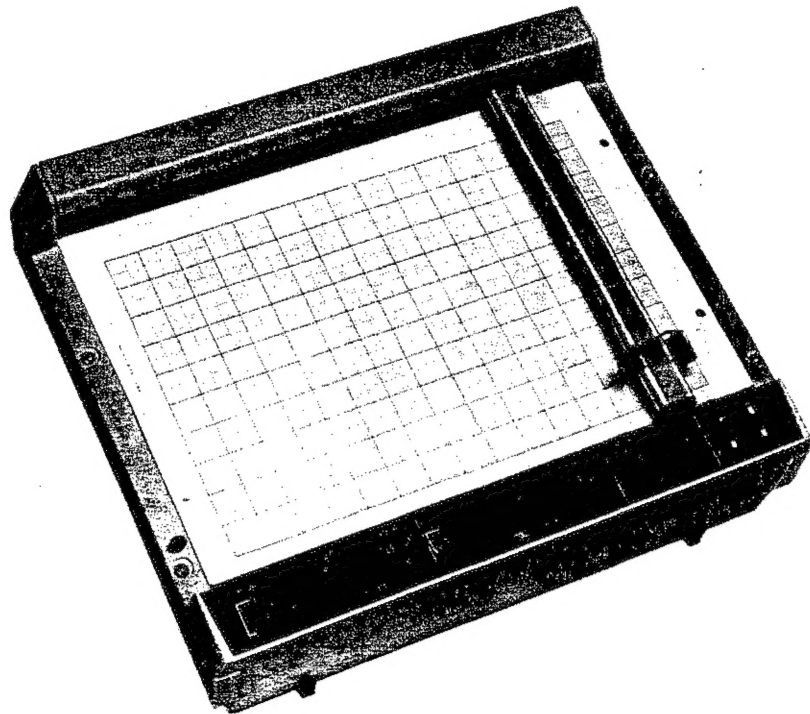


OPERATING AND SERVICE MANUAL

7044B/7045B**X-Y RECORDER****HEWLETT
PACKARD**

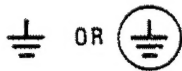
General Definitions of Safety Symbols Used On Equipment



International caution symbol (refer to manual): the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.



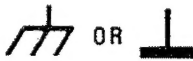
Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.



Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current



Direct current



Alternating or direct current



The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury.



The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.



HEWLETT
PACKARD

OPERATING AND SERVICE MANUAL

7044B/7045B X-Y RECORDER

SERIAL NUMBERS

This manual applies directly to recorders with serial numbers prefixed 2047A.

For additional important information about serial numbers, see Recorders Covered by Manual in Section I.

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16399 W. BERNARDO DRIVE, SAN DIEGO, CALIFORNIA 92127

MANUAL PART NO. 07044-90006
Microfiche Part No. 07044-90056

Printed: NOVEMBER 1980



SECTION I

INTRODUCTION

1.1 DESCRIPTION.

1-2. BASIC FRAME.

1-3. The Hewlett-Packard Models 7044B and 7045B X-Y Recorders are designed for the laboratory user to plot cartesian coordinate graphs from dc electrical information. The 7044B or 7045B will satisfy the needs of the user seeking reliability and dependability. The 7045B recorder features high speed capability and rapid acceleration to accurately record high-frequency and fast-moving input signals. It also offers a RESPONSE switch which allows the user the choice of a fast or slow response. Both models are equipped with the newly designed, continuous duty, aluminum framed dc servo motor; the X-axis of the 7045B contains the larger, faster motor. This design concept ends overheating or wear if the pen is driven offscale for an indefinite time. Other features found on the 7044B and 7045B include 14 calibrated dc input ranges in each axis from 0.5 mV/in. (0.25 mV/cm) to 10 V/in. (5 V/cm), TTL Remote Control, and a Rear Connector. Arbitrary full scale voltage ranges may be established with a variable input vernier in conjunction with the calibrated dc ranges. A trouble-free electrostatic hold-down platen capable of holding chart paper up to 11 x 17 inches and the standard European A3 size, a disposable pen with four color choices, and plastic coated wirewound balance potentiometer are also provided on both models. Latest circuitry design and assembly techniques have also been incorporated into both models, thereby reducing failure and maintenance time. Additionally, both recorders can be equipped with such options as Time Base, Event Marker, or Metric Scaling. See Figures 1-1 and 1-2 depicting the standard 7044B and 7045B models.

1-4. MODEL - MANUAL INFORMATION.

1-5. The contents of this manual apply to recorders with the serial number prefix(es) listed under SERIAL NUMBERS on the title page. The serial prefix is the first four digits and a letter of a two-part, ten-item serial number (0000A-00000) used to identify each Hewlett-Packard instrument (see Figure 1-3). Should any change to this manual be necessary, a new serial prefix will be assigned to the changed model and a change sheet (Manual Change) will be supplied defining the differences between the changed model and the one described within this manual. Other corrections due to any errors that existed when this manual was printed will be provided. This type of change, called Errata, also appears on the change sheet (Manual Change). For additional information pertaining to these recorders, or other

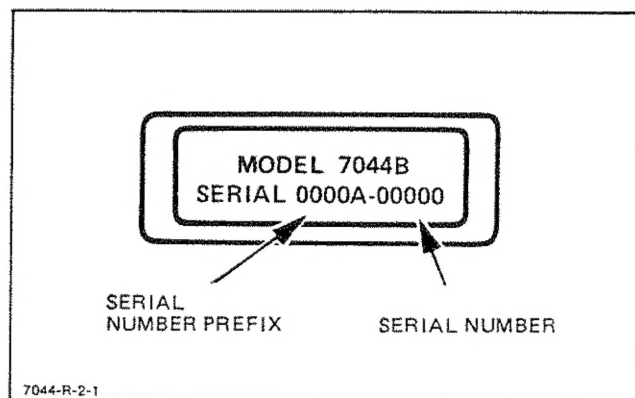


Figure 1-3. Instrument Identification

Hewlett-Packard instruments, contact the nearest Hewlett-Packard Sales/Service Office.

1-6. SPECIFICATIONS.

1-7. Table 1-1 lists the specifications and accessories supplied or available with the 7044B and 7045B models. Figure 1-4 illustrates the outside dimensions. Option specifications are also defined in this section.

1-8. SAFETY SYMBOLS.

1-9. The following safety symbols are used with this Operating and Service Manual.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

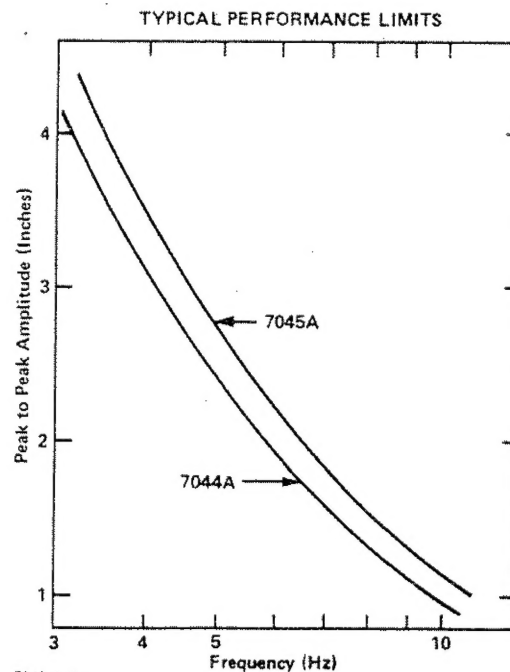
CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

TABLE 1-1. SPECIFICATIONS

PERFORMANCE SPECIFICATIONS.

Input Ranges:	0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 mV/in., 1, 2, 5, 10 V/in. (metric capability available in 0.25, 0.5, 1, 2.5, 5, 10, 25, 50, 100, 250, 500 mV/cm, 1, 2.5 V/cm). Continuous vernier between ranges.
Type of Input:	Floating 30 Vdc or peak ac maximum. Polarity reversal switch located on front panel, guard internally connected. Inputs through front panel 5-way binding posts or optional rear connector. Pen lift control is also available through rear-mounted banana jack connectors, or a 37-pin rear connector.
Input Resistance:	1 megohm constant on all ranges.
Common Mode Rejection	110 dB dc and 90 dB ac at 50 Hz and above with 1 K ohm between HI and LO terminals, CMR voltage applied between ground and LO, and attenuator on most sensitive range. On other ranges CMR decreases 20 dB per decade step in attenuation.
Slewing Speed:	7044B — 20 in/sec (50 cm/sec) minimum 7045B — (Fast Response) 30 in/sec (76 cm/sec) minimum; (Slow Response) 15 in/sec (36 cm/sec) typical.
Acceleration:	7044B — Y-axis, 1000 in/sec ² . (2540 cm/sec ² .) X-axis, 500 in/sec ² . (1270 cm/sec ² .) 7045B — (Fast Response) Y-axis 3000 in/sec ² . (7620 cm/sec ² .) X-axis 2000 in/sec ² . (5080 cm/sec ² .) (Slow Response) Y-axis 2500 in/sec ² . (6350 cm/sec ² .) X-axis 1500 in/sec ² . (3800 cm/sec ² .)



Accuracy:	±0.2% of full scale (includes linearity and deadband) at 25°C. Temperature Coefficient ±0.01% per °C.
Range Accuracy:	±0.2% of full scale ±0.2% deflection (includes linearity and deadband) at 25°C. Temperature Coefficient ±0.01% per °C.
Deadband:	0.1% of full scale.

TABLE 1-1. SPECIFICATIONS (Continued)

Overshoot:	7044B — 2% of full scale (maximum). 7045B — 1% of full scale (maximum).
Zero Offset:	Zero may be placed anywhere on writing area or electrically off scale up to one full scale from zero index.
Relative Humidity:	5% to 95% (below 40°C).

TTL REMOTE CONTROL.

Operating Levels:	Contact closure (0.2 mA) to ground or TTL levels. Logic (0): Between -0.5 Vdc and +0.4 Vdc. Logic (1): Between +2.4 Vdc and 5.5 Vdc.
-------------------	--

REAR CONNECTOR.

Connects Event Marker and TTL.

Provides X and Y inputs and pen lift TTL controls.

Supplies START and RESET remote capability.

TTL and Rear Connector provide Electrostatic Holddown and Servo Standby capability on Model 7044B. Additionally, X and Y Response on Model 7045B.

REMOTE PEN LIFT.

Banana Jacks provide remote control of pen lift.

GENERAL SPECIFICATIONS.

Writing Mechanism:	Servo actuated ink pen.
Writing Area:	10 in. x 15 in. (25 cm x 38 cm).
Paper Holddown:	Electrostatic paper holddown grips charts 11 in. x 16.5 in. and standard European size A3 (29,7 cm x 42 cm) or smaller. Special paper not required.
Pen Lift:	Electric (Remote, via contact closure or TTL level).
Power:	100, 120, 220, or 240 volts ac +5 -10%, 48 to 440 Hz; 7044B, 135 VA; 7045B, 175 VA
Weight:	7044B: Net, 30 lb (13,7 kg); shipping 42 lb (19,1 kg). 7045B: Net, 30 lb (13,7 kg); shipping 44 lb (20 kg).

1-10. OPTIONS.

1-11. Optional features available for the two models are specified in Table 1-2. The following paragraphs describe these features which may be built into or combined with these recorders. Table 1-3 contains the specifications of the options.

1-12. TIME BASE — OPTION 001.

1-13. Eight speeds from 0.5 sec/in. to 100 sec/in. are available for both models in either the X or Y-axis. In the 7045B model, however, with the addition of the RESPONSE switch, the selection of the X or Y-axis time base sweep

speed automatically results in the SLOW response of that selected axis; the other axis is not affected and operates normally. (May be ordered only at time of recorder purchase.) See Figure 1-5.

1-14. EVENT MARKER — ELECTRIC — OPTION 002.

1-15. A remotely controlled event marker, installed at the top of the Y arm, identifies significant events in a recording sequence by making an upward deflection in the margin at the top of the chart paper. See Figure 1-6. The cartridge-type pen is actuated by a remote contact closure. This option may be field installed.

1-16. METRIC SCALING – OPTION 006.

1-17. Metrically scaled and calibrated version of either recorder is provided. (May be ordered only at time of recorder purchase.)

1-18. ACCESSORIES.

1-19. Included in the standard Accessory Kit are a package of red and blue disposable pens, slidewire cleaner, and a mating connector. Additional accessories are added when certain options are added.

TABLE 1-2. OPTIONS

OPTION	DESCRIPTION
001	Time Base X or Y
002	Event Marker (Electric)
006	Metric

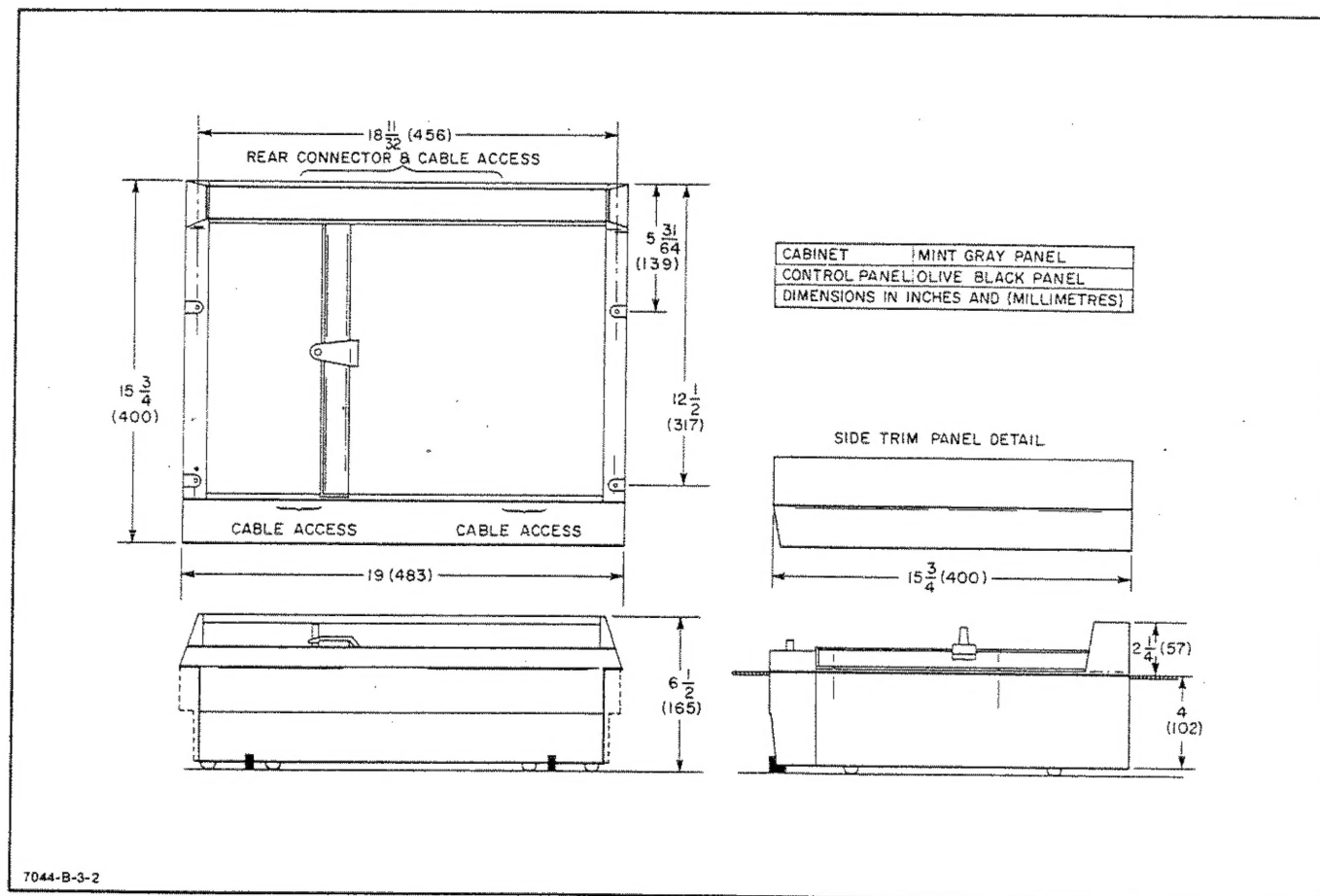


Figure 1-4. Model 7044B / 7045B Dimension Drawing

TABLE 1-3. OPTION SPECIFICATIONS

TIME BASE — OPTION 001

Sweep Rates: Eight selectable rates: 0.25, 0.5, 1, 2, 5, 10, 25, 50 sec/cm (0.5, 1, 2, 5, 10, 20, 50, 100 sec/in) X or Y axis. TTL sweep indication is provided.

Accuracy: $\pm 1\%$ full scale at 25°C ($\pm 0.1\%$ $^{\circ}\text{C}$ maximum).

Linearity: $\pm 0.5\%$ full scale at 25°C (to 0.04% / $^{\circ}\text{C}$ maximum).

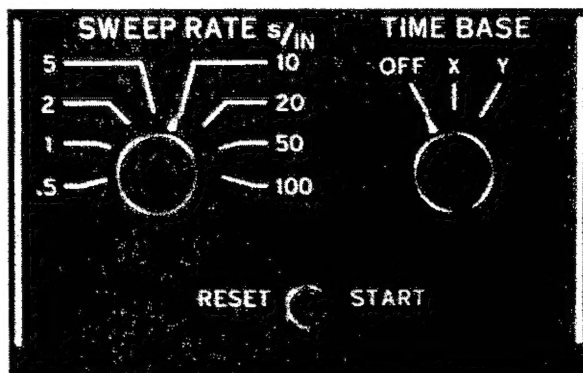
EVENT MARKER — ELECTRIC — OPTION 002

Marking Area: Upper margin aligned with X-axis position.

Excursion: Approximately 0.05 inch.

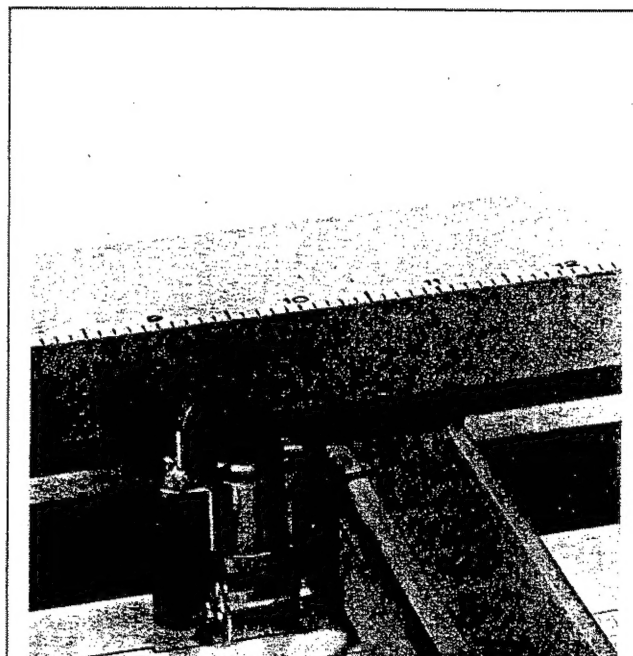
Ink Capacity: 0.45 cm^3 cartridge, writing distance 500 ft minimum.

Control: Remotely by contact closure to ground or TTL logic control.



7044-A-4-2

Figure 1-5. Time Base — Option 001



7044-A-5-1

Figure 1-6. Event Marker — Option 002



SECTION II

INSPECTION AND INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides information for incoming inspection, installation, storage, and shipping of the 7044B and 7045B X-Y Recorders. Also included is the information required to field install and/or modify options for the two models.

2-3. INCOMING INSPECTION.

2-4. MECHANICAL CHECKS.

2-5. Inspect the recorder for mechanical damage, scratches, dents, or other defects. Also check the cushioning materials for signs of severe stress.

2-6. ELECTRICAL CHECKS.

2-7. The electrical performance of the recorder should be verified upon receipt. Performance checks, suitable for incoming inspection as well, are presented in Section V.

2-8. DAMAGE CLAIMS.

2-9. If the recorder is damaged in transit, or fails to meet specifications upon receipt, notify the carrier and the nearest Hewlett-Packard office immediately. A list of field offices is conveniently located in the back of this manual. Retain the shipping carton and padding material for the carrier's inspection. The field office will arrange for replacement or repair of your recorder without waiting for claim settlement against the carrier.

2-10. STORAGE.

2-11. When the recorder is to be stored for a period of time, the disposable pen and the event marker cartridge (if Option 002 is installed) should be removed and the upper part of the carriage arm clamped to the right side of the recorder to prevent damage during handling. Flush event marker ink lines out with water. Seal the recorder in moisture-proof covering with desiccant and repackage in a container similar to the original factory carton.

2-12. SHIPPING.

2-13. Before returning the recorder for any reason, notify the local field sales office of the difficulty encountered giving the model and serial number of the recorder. They will furnish shipping instructions. The following

precautions should be taken when repackaging the recorder:

a. Remove disposable pen and event marker assembly (Option 002 if installed).

b. Clamp the upper end of carriage arm and pen carriage to the right side of recorder with shipping clamp (HP Part No. 07040-60921) to prevent movement while in transit.

c. Wrap recorder in heavy paper or plastic and surround with three to four inches of shock-absorbing material to cushion and prevent movement inside shipping container. Container should be sufficiently durable to prevent damage to recorder during handling. If in doubt, request a shipping carton from the nearest Hewlett-Packard Sales/Service Office.

2-14. RECORDER INSTALLATION.

2-15. MECHANICAL INSTALLATION.

2-16. The recorder is equipped with built-in rack mounting brackets for placing in a standard 19-inch cabinet. Four screws (two on each side) are used for easy installation. Feet and side trim panels are provided for bench type operation. Remove side trim panels before rack mounting. See Figure 2-1.

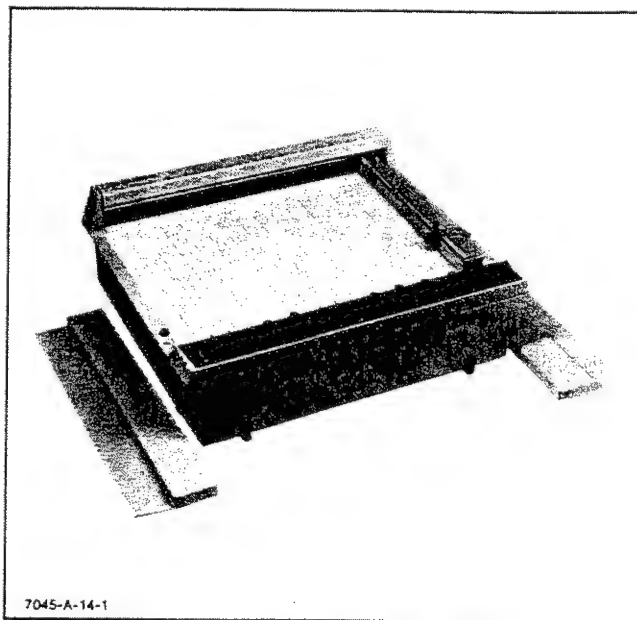


Figure 2-1. Side Trim Panel Removal

2-17. COOLING.

2-18. Cooling is provided by convection. The location of mounting of the recorder must ensure adequate air circulation.

2-19. OPTION INSTALLATION/CONVERSION.

2-20. These two models may be equipped with options which can increase the versatility and application to special

operating requirements. The following paragraphs describe those options that can be installed in the field.

2-21. EVENT MARKER – OPTION 002.

2-22. Installation is accomplished for either model per the instructions accompanying Event Marker Kit, Part Number 07044-60001.

SECTION III

OPERATING INSTRUCTIONS

3-1. OPERATING REQUIREMENTS.

3-2. INTRODUCTION.

3-3. The basic function of the Models 7044B and 7045B X-Y Recorders is to produce a cartesian coordinate graph showing the relationship between two variable functions. Slowly varying dc signals representing these functions are applied to the input terminals of the respective X and Y axis of the recorder and its controls adjusted so that the resulting graph will cover the desired region of the graph.

CAUTION

Before attempting to operate the recorder, the user should become familiar with the input requirements and various control functions as outlined in the following paragraphs.

3-4. CONTROLS, CONNECTORS, AND INDICATORS.

3-5. The front and rear panel controls, connectors and indicators are depicted and explained in Figures 3-1 and 3-3. The 37-pin rear connector is depicted in Figure 3-4.

3-6. ELECTRICAL REQUIREMENTS.

3-7. OPERATING POWER.

3-8. The ac power supplied to the models should be either 100, 120, 220 or 240 Vac, 48 to 440 Hz, single phase. Two voltage selector switches located on the underside of the recorder on the connector panel must be set to correspond to the available supply voltage. A 1.5-ampere time delay fuse is used for 100 or 120V operation and a 3/4-ampere time delay for 220 or 240V.

3-9. Power plugs used in the United States and other countries are shown in Figure 3-2. The plug rating and the HP Part Number for the plug and power cord are shown beside each plug. If the correct power cable is not available, notify the nearest Hewlett-Packard Sales and Service Office and a replacement cable will be provided.

3-10. INPUT SIGNALS.

3-11. The recorder's input terminals (HI and LO), located on the front panel, must be supplied with varying dc signals. These signals should vary at a rate within the response capabilities of the recorder and have amplitudes within their

scale ranges or an erroneous recording may result. It is possible to have an excessive amount of ac noise present in the input signals, thereby resulting in recorder response becoming oscillatory and inaccurate. It is important that the side of the signal with the lowest impedance to ground side is connected to the LO input terminal of the recorder. If this results in the recorder axis moving in the wrong direction, reset POLARITY switch to +RT or -RT for X-axis or to +UP or -UP for the Y-axis. If excessive normal mode noise is present on the input signals, an external filter(s) may be necessary.

3-12. GROUNDING.

3-13. For optimum performance, the center prong of the ac power cord must be grounded. When operating from ungrounded power sources, a secondary grounding method is mandatory.

3-14. OPERATING PRECAUTIONS.

3-15. SERVO.

3-16. To avoid unnecessary wear on the balance potentiometers and other mechanical parts, place the SERVO toggle switch in STANDBY when not recording.

3-17. If the input voltage exceeds the range setting, the pen will move quickly to one end of its travel and strike the drive mechanism stop. The motor will stop, protecting the recorder against damage until the input signal returns to an onscale value.

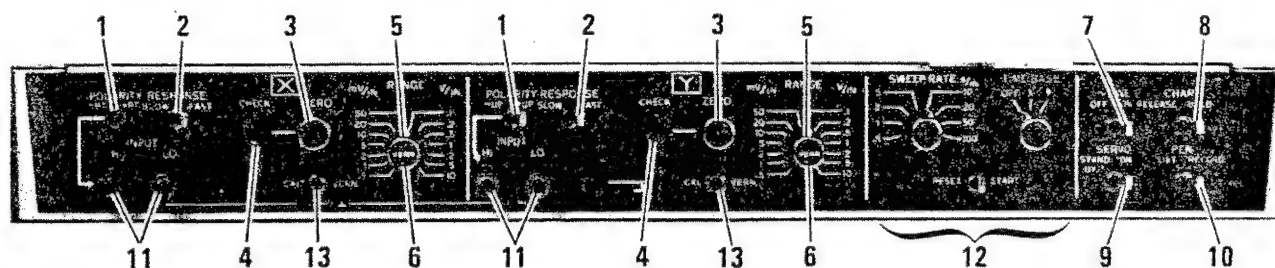
3-18. RESPONSE SWITCH.

3-19. On the 7045B, position RESPONSE toggle switch in SLOW position. This permits making prerecording span and zero adjustments without the pen and arm driving against the stops at full slewing speed. This position also enables the user to record slow input signals or reduce the speed of the recorder.

3-20. OPERATING INSTRUCTIONS.

3-21. CONNECT POWER.

3-22. Set the power voltage selector switch, located on the underside of the recorder, to either 100, 120, 220, or 240V +5-10% depending on the available power source. Connect the power cord between the power receptacle and the power source.



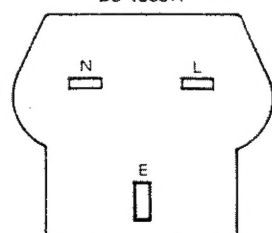
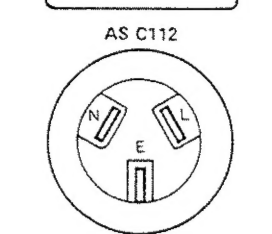
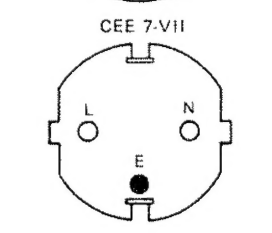
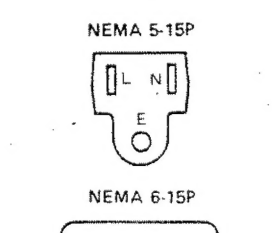
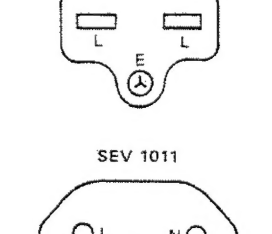
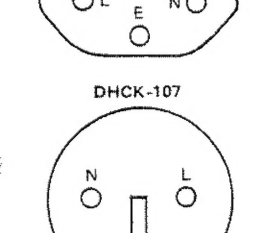
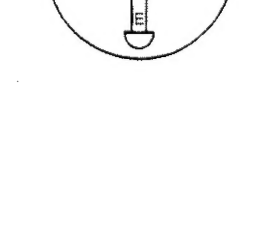
7044-A-8-2

1. POLARITY SWITCHES (-RT +RT, -UP, +UP). Two toggle switches; one for the X-axis and the other for the Y-axis; provide polarity reversal.
2. RESPONSE SWITCH (7045B ONLY). A two-position toggle switch labeled SLOW and FAST. Use SLOW position for making prerecording adjustments, and also, if desired, record slow incoming signals or reduce speed of instrument.
3. ZERO CONTROLS. A control in each axis for adjusting the pen's zero position on the chart.
4. ZERO CHECK SWITCHES. A pushbutton switch to verify the zero setting of either the X or Y axis. When actuated, the input signal is disconnected and the pen returns to its zero position.
5. RANGE SWITCHES. A selector switch for each axis allowing the selection of 14 calibrated positions.
6. VERNIER CONTROL. A vernier control in each axis for multiplication of input range setting; overlaps two adjacent calibrated ranges.
7. LINE SWITCH. A two-position toggle switch; OFF and ON; that controls the application of the ac line voltage to the recorder.
8. CHART SWITCH. A two-position toggle switch; RELEASE and HOLD; that controls the chart holding function of the Autogrip table.
9. SERVO SWITCH. A two-position toggle switch; STANDBY and ON; that controls servo actuation for both axes.
10. PEN SWITCH. A two-position toggle switch; LIFT and RECORD; that controls the lowering and raising of the pen.
11. INPUT TERMINALS. Two input terminals are available for each axis. They are labeled HI and LO and will accept either open wire or banana plug connectors.
12. TIME BASE - OPTION 001. One control knob for the selection of eight sweep speeds in either axis. To determine the axis, place toggle switch from OFF to X or Y, then select sweep using sweep rate knob. RESET/START toggle switch stops sweep cycle, lifts pen, and resets pen to original starting position when placed in RESET; in START position, drops pen, sweeps pen across chart at selected rate.
13. VERNIER SWITCH: A selector switch for each axis which allows the vernier control to be switched ON or OFF.

CAUTION

Disconnect input signal from axis, which has been placed in Time Base Mode, before starting sweep cycle.

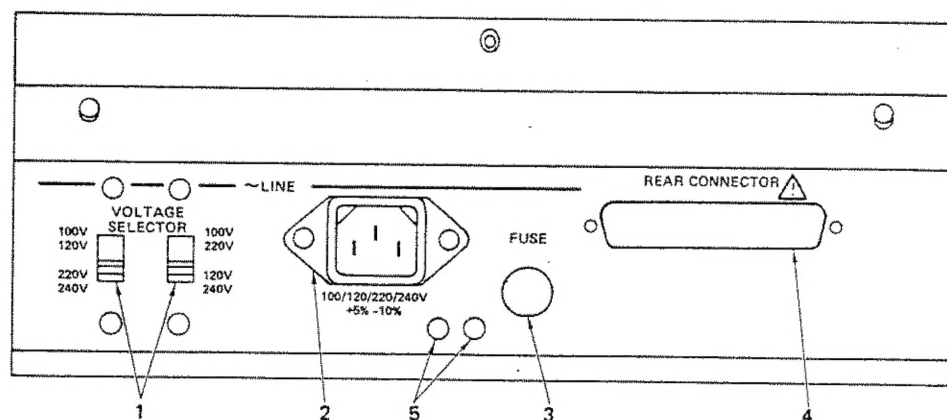
Figure 3-1. Control Panel - 7044B and 7045B

		Option Number
<p>BS 1363 A</p> 	<p>HP Part Number 8120-1351; 250V, 13A, 1ϕ plug rating. (For use in United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore)</p>	900
<p>AS C112</p> 	<p>HP Part Number 8120-1369; 250V, 10A, 1ϕ plug rating. (For use in Australia, New Zealand)</p>	901
<p>CEE 7-VII</p> 	<p>HP Part Number 8120-2857; 250V, 10/16A, 1ϕ plug rating. (For use in East and West Europe, Saudi Arabia, Egypt)</p>	902
<p>NEMA 5-15P</p> 	<p>HP Part Number 8120-1378; 125V, 15A, 1ϕ plug rating. (UL approved; for use in United States, Canada, Japan, Mexico, Philippines, Taiwan)</p>	903
<p>NEMA 6-15P</p> 	<p>HP Part Number 8120-0698; 250V, 15A, 1ϕ plug rating. (UL approved; for use in United States)</p>	904
<p>SEV 1011</p> 	<p>HP Part Number 8120-2104; 250V, 10A, 1ϕ plug rating. (For use in Switzerland)</p>	906
<p>DHCK-107</p> 	<p>HP Part Number 8120-2956; 250V, 10A, 1ϕ plug rating. (For use in Denmark)</p>	912

NOTE: All plugs are viewed from connector end.

- L = Line or Active Conductor (also called "live" or "hot")
- N = Neutral or Identified Conductor
- E = Earth or Safety Ground

Figure 3-2. Power Cord Configurations



1. **VOLTAGE SELECTOR SWITCHES:** These two switches are positioned to correspond with the AC line input voltage. Any voltage of 100, 120, 220, or 240 volts AC.
2. **POWER CORD RECEPTACLE:** Use the power cord provided with the recorder.
3. **FUSE HOLDER:** For line fuse:

7045B:	100 or 120 volts 220 or 240 volts	1.5 AT (P/N 2110-0304) 750 mA (P/N 2110-0360)
7044B:	100 or 120 volts 220 or 240 volts	1 AT (P/N 2110-0007) 500 mA (P/N 2110-0202)
4. **REAR CONNECTOR:** A 37-pin connector for the input of all signals except power. A mating connector is supplied in the accessory kit.
5. **PEN LIFT (TTL):** Banana jack connector for remote control of the pen lift and 100 millisecond servo delay.

7044-A-9-2

Figure 3-3. Rear Panel

3-23. ENERGIZE RECORDER.

3-24. Place the **LINE** toggle switch to the **ON** position. This will furnish power to the recorder.

3-25. INSTALL PAPER.

3-26. Place chart paper on the recording platen and align the left edge with the paper stop. To energize the platen, place **CHART** toggle switch to **HOLD**.

3-27. INSTALL PEN.

3-28. The disposable pen is pushed into the notched holder located on the scale, and twisted clockwise to lock in holder.

CAUTION

The disposable pen incorporates a precision writing tip. Care must be taken not to damage this tip during pen changing or other handling. Writing by hand on any surface may damage pen tip. Use pen in pen holder on recorder.

3-29. SET VERNIER CONTROL.

3-30. Vernier control enables operator to adjust recorder sensitivity to any value between fixed ranges. It is often used to adjust the recorder sensitivity to align with actual function to be measured — not necessarily voltage (i.e. 100 lbs/in., 20 dB/in.).

3-31. CONNECT INPUTS.

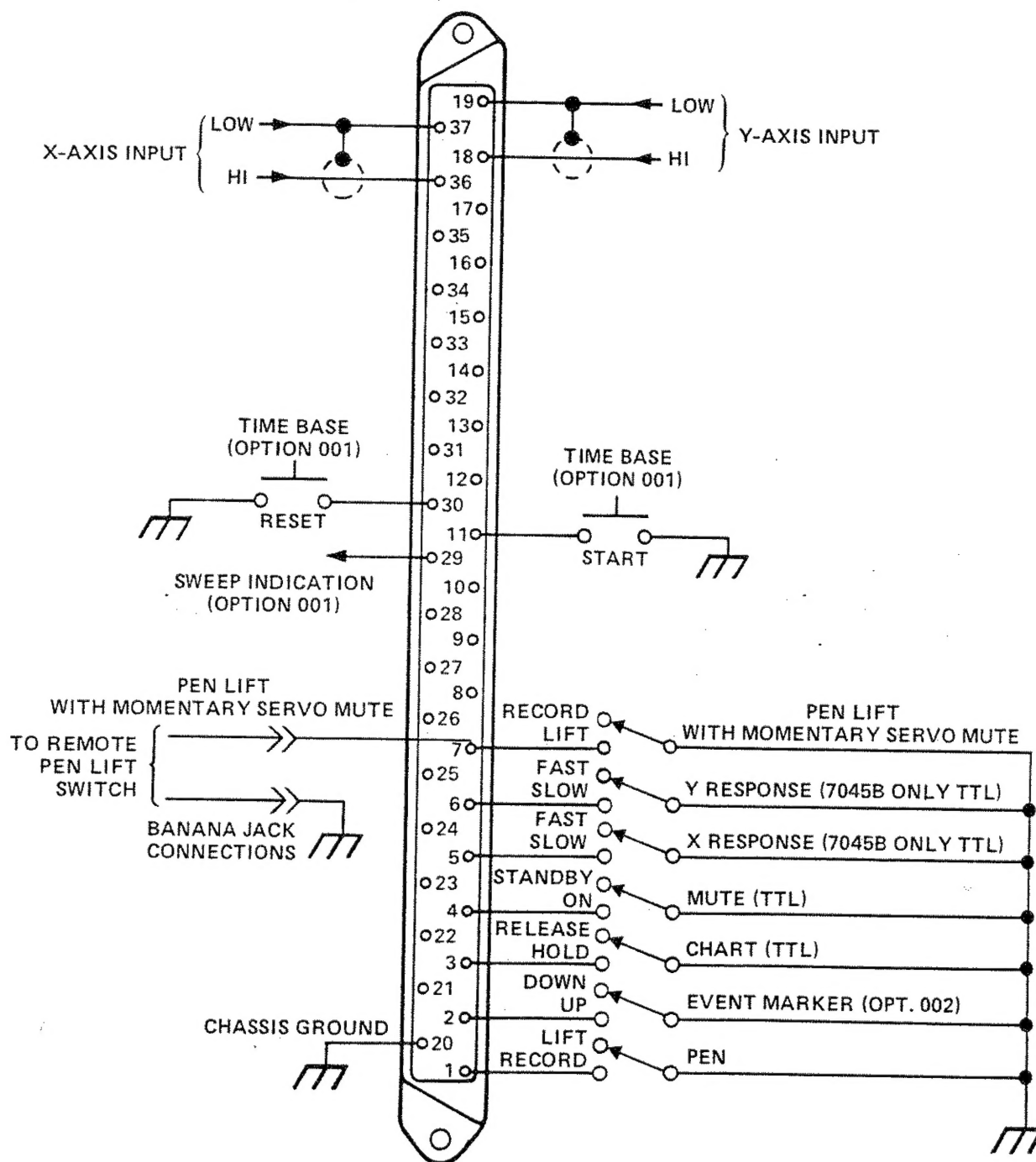
3-32. Connect the signal inputs to each axis through the front input terminals using open wires or banana connectors.

3-33. ZERO SET.

3-34. Connect the input signals to the recorder and adjust the zero position so that the resulting graph will cover the desired area on the paper.

3-35. LOWER PEN.

3-36. Lowering the pen for recording purposes is accomplished by positioning the **PEN** toggle switch to **RECORD**. When **TTL** is installed, pen lowering is energized by level changes to less than +0.4 Vdc. Changing level to between +2.4 and +5.5 volts will raise the pen.



7044-A-10-2

Figure 3-4. Rear Connector



1000